

CLAIMS

The invention claimed is:

1. An electrochemical battery cell comprising:
a non-hermetically sealed housing comprising a first wall having at least one air
5 inlet;
an oxygen reduction electrode disposed within the housing and comprising an
oxygen reduction layer and an electrolyte impermeable layer, the electrolyte impermeable
layer being disposed between the oxygen reduction layer and the first wall of the
container;
10 an electrolyte disposed within the housing; and
a transformable component disposed between the housing wall having the at least
one air inlet and the oxygen reduction electrode;
wherein the transformable component, when contacted by the electrolyte, is
capable of transformation to an electrolyte sealing component.
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2. The cell defined by claim 1, wherein the electrolyte sealing component completely
blocks electrolyte passage to the at least one air inlet.
3. The cell defined by claim 1, wherein the transformable component comprises pores
20 and has a porosity.
4. The cell defined by claim 3, wherein the pores comprise through-pores and the
transformation comprises a reduction in the number of through-pores.
- 25 5. The cell defined by claim 3, wherein the transformation comprises a reduced
porosity.
6. The cell defined by claim 5, wherein the reduced porosity comprises at least
partially collapsed pores.
- 30 7. The cell defined by claim 6, wherein the transformable component comprises a
material, disposed within the pores, that is capable of adhesively sealing the at least
partially collapsed pores.

8. The cell defined by claim 3, wherein the transformable component comprises a swellable material disposed within the pores and the swellable material is capable of swelling upon contact with the electrolyte.

9. The cell defined by claim 1, wherein the transformable component is capable of swelling upon contact with the electrolyte.

10. The cell defined by claim 9, wherein a surface of the electrolyte sealing component cooperates with the first wall of the housing to comprise at least a partial electrolyte seal.

11. The cell defined by claim 10, wherein the electrolyte sealing component is a first electrolyte sealing component and a second electrolyte sealing component is disposed between and cooperates with the first electrolyte sealing component and the first wall of the housing to comprise the at least partial electrolyte seal.

12. The cell defined by claim 9, wherein the transformable component is constrained between the oxygen reduction electrode and the container such that the pores are at least partially collapsed upon swelling of the transformable component.

13. The cell defined by claim 1, wherein the transformable component comprises at least one member selected from the group consisting of polyacrylates, polyvinyl alcohols and polyamides.

14. The cell defined by claim 13, wherein the transformable component comprises a base material comprising pores, and at least a portion of the at least one member selected from the group consisting of polyacrylates, polyvinyl alcohols and polyamides is disposed in the pores.

15. The cell defined by claim 14, wherein the at least one member comprises at least one polyvinyl alcohol.

16. The cell defined by claim 14, wherein the at least one member comprises at least one polyamide.

17. The cell defined by claim 14, wherein the at least one member comprises at least one polyacrylate.

5 18. The cell defined by claim 1, wherein the transformable component comprises an electrolyte absorbing material.

19. The cell defined by claim 1, wherein the transformable component comprises an electrolyte neutralizing material.

10 20. The cell defined by claim 1, wherein a first air permeable layer is disposed between the first wall of the container and the air electrode, adjacent to the hydrophobic layer.

15 21. The cell defined by claim 20, wherein the first air permeable layer comprises the transformable component.

22. The cell defined by claim 20, wherein a second air permeable layer is disposed between the first air permeable layer and the first wall of the housing, and the second air permeable layer comprises the transformable sealing component.

20 23. The cell defined by claim 1, wherein the cell is a metal-air cell.

24. The cell defined by claim 23, wherein the electrolyte comprises an alkaline solution of an electrolyte solute in water.

25 25. The cell defined by claim 24, wherein the cell is a zinc-air cell.

26. The cell defined by claim 25, wherein the oxygen reduction electrode comprises carbon.

30 27. The cell defined by claim 25, wherein the oxygen reduction electrode comprises a manganese oxide.

35 28. The cell defined by claim 1, wherein the cell is an air-assisted cell.

29. The cell defined by claim 28, wherein the electrolyte comprises an alkaline solution of an electrolyte solute and water.
- 5 30. The cell defined by claim 29, wherein the cell comprises a zinc-manganese dioxide cell.
31. The cell defined by claim 1, wherein the cell is a cylindrical cell having a height and a diameter.
- 10 32. The cell defined by claim 31, wherein the cell is a button type cell in which the cell height is less than the cell diameter.
33. The cell defined by claim 31, wherein the cell height is equal to or greater than the cell diameter.
- 15 34. The cell defined by claim 1, wherein the cell is non-cylindrical.
35. The cell defined by claim 1, wherein the cell is a prismatic cell.
- 20 36. The cell defined by claim 1, wherein the at least one air inlet is defined by an aperture in the first wall of the housing.
37. The cell defined by claim 1, wherein the at least one air inlet is disposed at an edge of the first wall of the housing.
- 25 38. The cell defined by claim 1, wherein the housing comprises a plurality of walls, each having at least one air inlet, and the cell comprises one or more transformable components such that the one or more transformable sealing components are disposed between the oxygen reduction electrode and all of the air inlets.
- 30 39. An electrochemical battery cell comprising:
a non-hermetically sealed housing comprising a first wall having at least one air inlet;
an oxygen reduction electrode disposed within the housing;
35 an electrolyte disposed within the housing;

an initially air permeable component disposed between the oxygen reduction electrode and the first wall of the housing, the initially air permeable component comprising a material that, when contacted by the electrolyte, is capable of transforming the initially air permeable component into an electrolyte sealing component.

5 40. The cell defined by claim 39, wherein the initially air permeable component comprises a base material and a transformable material.

41. The cell defined by claim 40, wherein the base material comprises pores in which
10 the transformable material is disposed.

42. The cell defined by claim 39, wherein the electrolyte comprises an alkaline solution of an electrolyte solute in water.

15 43. The cell defined by claim 42, wherein the electrolyte solute comprises potassium hydroxide.

44. The cell defined by claim 42, wherein the transformable material comprises at least one material selected from the group consisting of polyacrylates, polyvinyl alcohols and
20 polyamides.

45. The cell defined by claim 44, wherein the initially air permeable component comprises a base material comprising pores in which the transformable material is disposed.

25 46. The cell defined by claim 44, wherein the transformable material comprises at least one polyacrylate.

47. The cell defined by claim 44, wherein the transformable material comprises at least
30 one polyvinyl alcohol.

48. The cell defined by claim 44, wherein the transformable material comprises at least one polyamide.

35 49. The cell defined by claim 48, wherein the initially air permeable material comprises base material comprising pores, at least a portion of the at least one polyamide

is disposed within the pores and the initially air permeable material comprises less than 305 mg of the at least one polyamide per cm³ of the base material.

50. The cell defined by claim 49, wherein the initially air permeable material
5 comprises no more than 295 mg of the at least one polyamide per cm³ of the base material.

51. The cell defined by claim 49, wherein the initially air permeable material
comprises at least 110 mg of the at least one polyamide per cm³ of the base material.

10 52. The cell defined by claim 51, wherein the initially air permeable material
comprises at least 174 mg of the at least one polyamide per cm³ of the base material.

53. The cell defined by claim 49, wherein the initially air permeable material has an
initial porosity of up to 60 percent.

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54. An electrochemical battery cell comprising:
a non-hermetically sealed housing comprising a first wall having at least one air
inlet;
an oxygen reduction electrode disposed within the housing and comprising an
20 oxygen reduction layer and an electrolyte impermeable layer, the electrolyte impermeable
layer being disposed between the oxygen reduction layer and the first wall of the
container;
an electrolyte disposed within the housing; and
a transformable component comprising a base material comprising pores disposed
25 between the housing wall having the at least one air inlet and the oxygen reduction
electrode;
wherein the transformable component comprises a surface facing the oxygen
reduction electrode, a pressure applied to that surface is capable of transforming the
transformable component to an electrolyte sealing component and the transformation
30 comprises at least a partial collapse of the pores.